Indo-Malayan Cirripeds in the Raffles Museum, Singapore

By C. A. NILSSON-CANTELL, PH. DR.

(VENERSBORG, SWEDEN)

PLATE V

INTRODUCTION

A collection of cirripeds in the Raffles Museum, Singapore was offered me for determination by the Director of the Museum, Mr. F. N. Chasen. For this I wish here to express my best thanks to him and also to the Assistant Curator, Mr. M. W. F. Tweedie for the material sent and the information given.

The collection is of great interest as belonging to a region very rich in cirripeds and also fairly well known because material from this part of the oceans has been collected by several expeditions and also by cable steamers. A paper by Broch (1931) on Malayan cirripeds has recently been published. Also a paper on cirripeds from the same region (the material belonging to the Amsterdam Museum) has been completed by the author and will soon be in print. To avoid repetition of what is mentioned in this paper, I will here be rather brief.

The collection contains in all, as seen from the list here given, 21 different species and subspecies. Of these 12 are already dealt with in my paper above mentioned. One new species *Oxynaspis pulchra* and one new subspecies *Balanus amphitrite rafflesi* may here be registered. Some of the previously known forms have only once before been collected viz. *Heteralepas lithotryae* (Hoek) and *B. amphitrite poecilosculpta* Broch. It would have been of interest to find complemental males of *Sc. persona*, Ann. as none have been found in this species (comp. Nilsson-Cantell, 1931). Even for quite well-known species in the present collection many new localities are given. These localities and some supplementary additions follow in the systematic part. First a list of the species and localities, as well as the depth in metres from which they are taken is given. Some of the specimens of this collection have already been reported on by Annandale (1905 and 1916).

LIST OF THE SPECIES

SPECIES AND SUBSPECIES	LOCALITY	DEPTH IN M.
Pollicipes mitella (Linné)	Cantian, British North Borneo	..
Scalpellum stearnsii var. inerme Annandale	10° 32' 30" S. Lat. 120° 7' 30" E. Long.	238–915
Scalpellum persona Annandale	10° 32' 30" S. Lat. 120° 7' 30" E. Long.	238–915
Scalpellum sociabile Annandale	10° 32' 30" S. Lat. 120° 7' 30" E. Long.	238–915
Lithotrya nicobarica Reinhardt	Christmas Island	..
Ibla cumingi Darwin	Alligator Island, near Singapore	..
Oxynaspis pulchra n. sp.	10° 27' 46" S. Lat. 126° 4' 30" E. Long.	549
Lepas anserifera Linné	Butang Archipelago, Peninsular Siam	..
Heteralepas gigas (Annandale)	10° 32' 30" S. Lat. 120° 7' 30" E. Long.	238–915
Heteralepas japonica (Aurivillius)	10° 32' 30" S. Lat. 120° 7' 30" E. Long.	238–915
Heteralepas lithotryae Hoek	Christmas Island	..
Octolasmis warwicki (J. E. Gray)	Tanah Merah, Singapore; Siglap, Singapore	..
Octolasmis nierstraszi (Hoek)	5° 59' 6" N. Lat. 99° 8' 33" E. Long.	73
Balanus amphitrite variegatus Darwin	Seletar, Singapore	..
Balanus amphitrite cirratus Darwin	Singapore	..
Balanus amphitrite poecilosculpta Broch	1° 26' 3" N. Lat. 102° 58' E. Long.	33
Balanus amphitrite rafflesi n. subsp.	Pulau Sakra, near Singapore	..
Balanus amaryllis Darwin	5° 59' 6" N. Lat. 99° 8' 33" E. Long.	73
Balanus ciliatus Hoek	5° 59' 6" N. Lat. 99° 8' 33" E. Long.	73
Tetraclita porosa viridis Darwin	Raffles Lighthouse, Singapore	..
Chelonibia patula (Ranzani)	Raffles Lighthouse, Singapore	..

Systematic Part

LEPADOMORPHA Pilsbry

Family Scalpellidae Pilsbry

Genus Pollicipes Leach, 1817.

Pollicipes mitella (Linné, 1767).

New locality: Gantian, British North Borneo, 1899.

Distribution: Indo-Pacific.

Genus Scalpellum Leach, 1817.

Scalpellum stearnsii var. inerme Annandale, 1905. Plate V, fig. 1.

Syn. Nilsson-Cantell, 1921.

Some specimens of Annandale's var. *inerme* of *Sc. stearnsii* are represented in this collection. One very large specimen: length of the capitulum 51 mm., breadth of capitulum 37 mm., length of peduncle 77 mm. and breadth of peduncle 28 mm. is here figured (Pl. V, fig. 1) and agrees well with the specimens figured by Annandale, 1905 Pl. VIII, 1. One specimen is attached to the capitulum of Sc. persona Annandale, 1916. To the discussion earlier given (Nilsson-Cantell, 1928) nothing need be added.

Locality: 10° 22′ 30″ S. Lat., 120° 7′ 30″ E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13.1° C., Jan. 1884. (Earlier reported on by Annandale, 1905, 1916).

Distribution: Malay Archipelago, Indian Ocean.

Scalpellum persona Annandale, 1916. Plate V, fig. 2.

Scalpellum persona Annandale, 1916, Calman, 1918.

This species is described by Annandale (1916) and discussed by Calman (1918). A superficial resemblance exists between this species and *Sc. alcockianum* Annandale, 1906 in the thick cartilaginous cuticle. To make out the real shape (Pl. V, fig. 2) of the valve this cuticle must be removed. The agreement with the figure given by Annandale (1916, Pl. V, 7) is complete.

Measurements in mm.:

Length of capitulum	..	..	31
Breadth of capitulum	..	..	28
Length of peduncle	..	..	32
Breadth of peduncle	..	..	16.5.

The caudal appendages were twice the length of the protopodite and composed of 15 segments, which is in good agreement with what Calman found (13–16 segments).

Locality: 10° 22′ 30″ S. Lat., 120° 7′ 30″ E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13, 1° C. Jan. 1884. One specimen attached to the capitulum of *Heteralepas gigas*. (Earlier reported on by Annandale, 1916).

Distribution: Malay Archipelago.

Scalpellum sociabile Annandale, 1905. Plate V, fig. 3.

Scalpellum sociabile Annandale, 1905, 1908, Nilsson-Cantell, 1928.

Scalpellum pellicatum Hoek, 1907.

Scalpellum sociabile var. *pellicatum* and *parviceps* (nov.) Annandale 1916, Broch 1931.

One specimen of *Scalpellum* belongs to *Sc. sociabile*, previously discussed by the author (1928). In a paper by Annandale (1916) it appears that he has also studied examples of this species from the same locality and preserved in the Raffles Museum.

Locality: 10° 22′ 30″ S. Lat., 120° 7′ 30″ E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13, 1° C. Jan. 1884. (Earlier reported on by Annandale, 1905, 1916).

Distribution: Malay Archipelago, Japan.

Genus Lithotrya G. B. Sowerby, 1822.

Lithotrya nicobarica Reinhardt, 1850.

For synonyms see Nilsson-Cantell, 1921 and Seymour Sewell 1926.

In a paper on cirripeds from Bonaire the synonyms of *Lithotrya* species are briefly discussed. (Nilsson-Cantell, 1933). In the above cited paper by Seymour Sewell *L. pacifica* Borradaile, 1900 is with some hesitation taken up as a synonym of *L. nicobarica*. In my opinion (Nilsson-Cantell, 1921) there is no difference between them. The difference in the length of the lateralia is not a character of systematic value. Sewell has given an exact study of several characters, especially the number of the laminae in the capitular valves, here of interest as regards the latera because the length of the latter is due to this. I do not think we have here a character of systematic importance. In younger individuals the number of the laminae is certainly not so high as in older ones. If the latera are broken which is often the case, the number of the laminæ is of course smaller.

A comparison of the internal parts is of interest showing good agreement between both species. The number of segments of the cirri and the caudal appendages as given by Nilsson-Cantell 1921, p. 221 and Seymour Sewell 1926, p. 307 is of special

interest as both authors state the size of the individuals examined. As seen from the tables the agreement is very good. The same is proved by comparison with the specimens of the collection here dealt with.

New locality: Christmas Island, Indian Ocean, Oct. 1932.

Distribution: Malay Archipelago, Indian Ocean, Oceania (New Zealand, Fiji, Paumotu Islands). Certainly the species must occur around many islands of the Pacific Ocean. The locality here given is the most southerly in the Malay Archipelago. The most eastern locality in Oceania is Paumotu Islands, given by Pilsbry for *L. pacifica*, 1907.

Fam. IBLIDÆ Annandale, 1909.

Genus Ibla Leach, 1825.

Ibla cumingi Darwin, 1851.

Syn. Nilsson-Cantell, 1921.

New locality: Alligator Island, near Singapore, April, 1933.

Distribution: Red Sea, Indian Ocean, Malay Archipelago, western part of the Pacific Ocean.

Fam. OXYNASPIDÆ Gruvel, 1905, Pilsbry, 1907) Nilsson-Cantell, 1921.

Genus Oxynaspis Darwin, 1851.

Oxynaspis pulchra n. sp. Text-fig. 1.

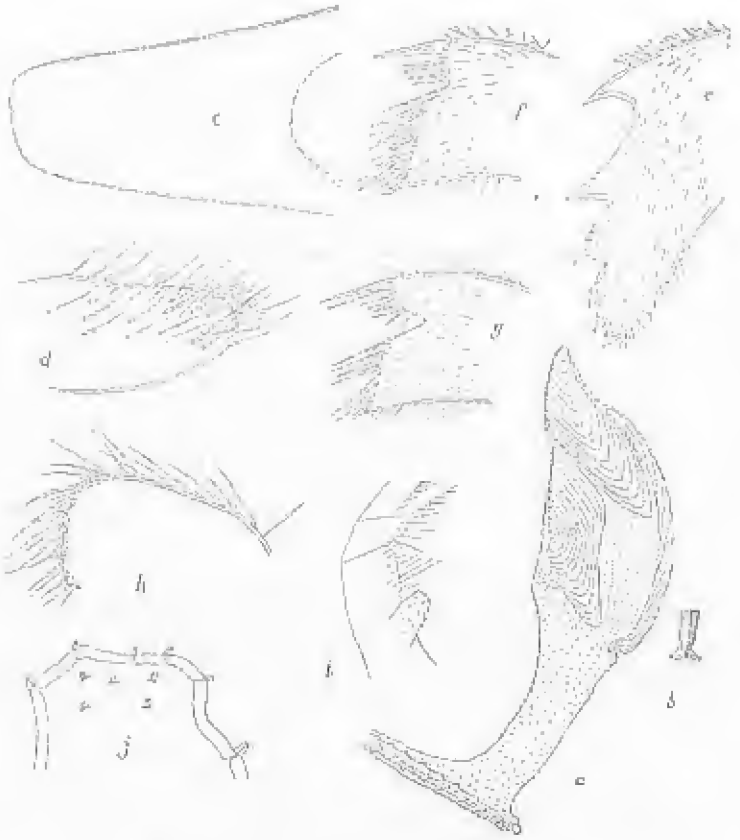
Diagnosis: Capitulum with five white valves with growth-lines and chitinous spines. The colour of all chitinous parts brown. Scutum relatively reduced, with subcentral umbo, nearly rhomboidal with carinal and basal margin somewhat concave. Tergum approximately triangular with occludent margin convex. Carina with nearly basal umbo, above this regularly arched; below the umbo the carina divides in a furca. Pedunculus narrow with chitinous spines. Labrum with teeth. Caudal appendage absent as also lateral and dorsal filaments. Inside of cirrus I with a protuberance and at the base of this a boss, both with small chitinous projections.

Description: A very interesting find of a pedunculate cirriped from a telegraph cable must here be noted as it is a representative of the little known genus *Oxynaspis* and also represents a new species quite distinct from those earlier known. Previously the following 7 species have been described: *Oxynaspis celata* Darwin, 1851 with the forma *indica* Annandale and *japonica* Broch, 1921, *O. patens* Aurivillius, 1894, *O. aurivillii* Stebbing,

1900, *O. boeki* Nilsson-Cantell, 1921, *O. terrae-novae* Totton, 1923, *O. connectens* Broch, 1931, *O. pacifica* F. Hiro, 1931. In all therefore 8 species of this genus associated with anthipatharians and sponges are now known, a small number in comparison with another pedunculate genus, *Scalpellum*. Certainly the genus *Oxynaspis* in reality contains only a few species.

Of the new species only one specimen has been collected, on which the description below is based. For the genus it is typical that the peduncle and capitulum is covered by small spines of the same appearance as those found on the anthipatharian. By several authors this is said to be caused by the over-growing of the horny and spiniferous bark of the anthipatharian. The fact of the soft parts growing over the barnacle is stated by Broch (1921) for *O. celata f. indica* as polyps also are situated on the capitulum of the cirriped. Yet we find in the literature opinions for and against this. Several authors, as for instance Aurivillius, who has studied *O. patens* is of the opinion that the spines are formed by the cirriped. Annandale too (1909) holds a similar opinion, but later (1914) the same author has given up this opinion. I have also myself from the study of specimens of *O. boeki* and *O. aurivillii*, said that the spines certainly belong to the animal. Totton, for *O. terrae-novae* has affirmed that the antipatharian has given off small branches over the cirriped. It was thus of great interest that Broch (1931) found a n. sp., *O. connectens* that does not live imbedded in coral but is fixed on a silicosponge. For the other species taken from coral he ascribes to the cirriped the fine horny layer next to the plates as well as the small (internal parts of the) spines; only the outer layer covering this fine cuticle is due to the anthipatharian (Broch, 1931 p. 37). It is interesting here to compare the new species in this collection with the others in this regard. As only a single specimen has been found no thorough study is possible. As far as I can see, the spines on the cirriped seem to belong to the cirriped. But this does not exclude the possibility of the whole cuticle being covered by a layer of the antipatharian. The full elucidation of this problem is a rather difficult matter for which richer material of the different species is necessary. But I do not think I am wrong if I say that in different species this covering is more or less rich. *O. celata* is more imbedded by the coral than *e.g.* the present new species *O. pulchra*, *O. connectens* and *O. boeki*. Without making any particular new contribution to this question, much written about, I merely wished to touch upon the question in giving the description of this new species. Other characters for this species are of more specific value, well separating the species from the related *O. connectens* Broch, 1931.

The capitulum has five valves which are of a white colour. They are covered by a thin cuticle which is not so thick as in *O. connectens*, while the valves have not the brownish hue of characteristic of that species. The growth-lines of the valves are distinct and regularly arranged.



Text-fig. 1. *Oxynaspis pulchra* n. sp.
a. Holotype, lateral view. b. Carina, lower part. c. Labrum. d. Palpus. e. Mandible. f, g. Maxilla I. h. Maxilla II. i. Inside of Cirrus I with protuberance. j. Top of the protuberance magnified.

The tergum is approximately triangular with the occludent margin convex. The basal margin is nearly straight. The carina in the upper part is concave, in the lower more convex. Umbo apical.

The scutum is of the typical shape and not reaching to the carina as in *O. connectens*. It is quadrangular. The occludent margin above the subcentral umbo is straight. Below this it is more hollowed out. The tergal margin is straight, about half the length of the occludent margin. The carinal margin is concave like the basal margin which is also a little irregular. The corners of this plate are rounded. The scutum is thus somewhat similar to that of *O. aurivillii* but quite unlike in finer details. There is also a less marked agreement with the scutum of *O. terrae-novae*, which species in many other characters, especially the carina, is distinct. It is not possible to regard this specimen as a variety of *O. connectens* with reduced scutum. Differences from this species are numerous, as I have seen by a study of Broch's type specimens.

The carina is regularly arched above the nearly basal umbo. The part below the umbo is formed as a furca. In this it almost agrees with *O. bocki* which however in other characters is different. The carina of *O. connectens* has a lower more flattened "plateshaped part with an attempt at forking." Broch's species, *O. connectens*, is, as seen by studying the type specimen, in the carina more like the species *O. celata* and *aurivillii* than the species *O. bocki* and the present new species, both of which have a distinctly forked carina.

The capitulum of this new species has a part free from the capitular valves. On this part as on the valves there are small spines more or less distinctly arranged in concentric lines.

The peduncle is relatively narrow with the above-mentioned small spines. The lower part is grown round the axis of the antipatharian, which axis is seen through the covering tissue. The colour is brown. I do not think this part of the specimen offers any character of specific value.

Measurements of the holotype in mm.:

Length of capitulum	.. ..	12
Breadth of capitulum	.. ..	6
Length of peduncle	.. ..	9.5
Breadth of peduncle	.. ..	2

Mouth-parts: The labrum is, as found in other representatives of this genus, prolonged, tongueshaped and hollowed out, not much pointed at the top. Fine denticles are present arranged in a semi-circular row as found in *O. bocki* and *O. aurivillii*. No denticles are mentioned for *O. connectens* Broch, 1931.

The palpus is conical but rather blunt, with bristles.

The mandible has three strong teeth with the upper margin pectinated. Below these there are two smaller teeth divided into

still smaller ones like the acute lower angle. In the other species the lower teeth are better developed than here. The number of teeth is not the same in all species.

The maxilla I. shows variation in the same specimen. The one maxilla has a broad notch below the upper spines, of which the first is the strongest. The lower part of the front edge has strong teeth paired as often is the case in cirripeds. The lower angle is distinctly marked and provided with small spines. The maxilla of the other side has a rather indistinct notch. The maxillae thus offer no important character of specific value. Broch (1922) found a similar variation in maxilla I. of *O. celata*.

The maxilla II. is of the typical shape for the genus *Oxynaspis* with a straight front edge. Bristles are placed in a continuous row along the front and upper margin.

Number of the segments of the cirri:

	I		II		III		IV		V		VI	
Holotype	7	9	12	13	15	16	15	15	15	15	15	16

Cirrus I. is shorter than and separated from the others. The longer cirri have 5 pairs of bristles on the front edge of the segments. Of special interest is the first cirrus in comparison with the description of *O. terrae-novae* given by Totton (1923). He describes on the inside of each proximal segment of the protopodite of this cirrus a protuberance with short spinules, not described in detail, and between the bases of the same cirri two conical bosses with spinules not mentioned for any other species of this genus. This new species seems to agree in this respect with *O. terrae-novae*. Both the protuberances as well as the bosses are found here. But as no detailed study has been made of the spinules in *O. terrae-novae* no comparison is possible in particulars. Perhaps there exists a dissimilarity in this respect. Both appendages in the specimen of the present collection have small protuberances of typical shape as seen from the figure. The small spinules seem to have a fine central channel with the opening at the top of the small cone. The function of this peculiar formation is difficult to decide. In Broch's species *O. connectens* which is described in great detail, these appendages are not mentioned. But a filamentary appendage is found at the outside of the base of each cirrus I. in both the above-mentioned species. A careful examination of the specimen here described revealed no such filamentary appendage. For the other species these filamentary appendages are not originally described. But Totton (1923) has

found them on material of *O. celata*. Perhaps there exist variations in this respect so that some species have them and some not. Also as regards the presence of dorsal filamentary appendages there seems to be variation. Broch in *O. connectens* found a single one in the median dorsal line and Totton in an unnamed species found two such dorsal appendages. In this new species I found none. For other species of *Oxynaspis* they are not mentioned.

The penis is of the typical shape.

The caudal appendages are not developed.

Locality: 10° 27′ 46″ S. Lat., 126° 4′ 30″ E. Long. *Depth:* 549 m. From a telegraph cable. 28-7-1913.

Discussion of the phylogeny of the genus.

A question of great interest, but always difficult to wholly clear up, is that of the phylogenetical affinities of a genus. Darwin was the first to offer some phylogenetical reflexions on the cirriped genera, including this genus. Later on discussions were propounded by Broch (1922, 1931), Nilsson-Cantell (1921, 1925) and Withers (1928). I cannot say that the authors mentioned wholly agree in this respect, but I think the difference in results is partly due to our rather incomplete knowledge of the species of this genus. Thus I think that what Broch (1931) says about my reasoning on this question: that it is "based on rather subjective sentiments" is typical for the reasoning of all authors who try to solve a question of so great difficulty. I will not in the following try to add much to what has already been said about the genus but only point to some facts of interest in this regard.

On my first study of this genus (1921) the internal parts, especially the filamentary and other above-mentioned appendages, were not known. I based my reasoning on a study of the mouth parts and naturally also the capitular valves. It is difficult to give up the phylogenetic connections of *Oxynaspis* and other pedunculate genera. After a study of the mouth parts I stated (1921) that the genus in these parts agrees with *Scalpellum* and *Trilasmis* (*Poecilasma*) and I will now add related genera *e.g. Octolasmis*. It is interesting to find that Broch also in other parts of the body *e.g.* the valves and filaments of a newly described species (1931) finds affinities with *Trilasmis* (*Poecilasma*) and the allied *Megalasma* with the subsp. *Glyptelasma* and *Megalasma*. But I do not think it is suitable to take up such different genera as *Lepas, Heteralepas, Oxynaspis* and *Trilasmis* and unite them under the same family as done by Broch (1931).

The different species of *Oxynaspis* agree in several characters, so there will be no hesitation in deciding whether a species is an *Oxynaspis* or not, but in the finer anatomical details there are considerable differences between the species. It seems to me that this phylogenetically rather old genus among the five-valved pedunculates is related to many genera. Like some other authors I have (1921) taken up the genus *Oxynaspis* as a separate group, and regarded it as a family. If we wish to try to group the pedunculates in series of related genera regarded by me as families we must keep the genus apart from *e.g.* the genus *Ibla* and the natural series *Lepas, Conchoderma, Alepas* and *Anelasma*, and further the series represented by *Trilasmis* (*Poecilasma*), *Octolasmis, Megalasma*, etc., and the group of *Heteralepas* with its two subgenera *Heteralepas* and *Paralepas*. For the discussion of this grouping I must refer to Nilsson-Cantell (1921) and the discussion given by Withers (1928). In my study of the phylogeny of the pedunculates I have avoided any assertion of the genus from which a genus is derived. If we study the literature we shall find rather different opinions on this difficult question. Broch (1922) derives the genus directly from *Trilasmis* (*Poecilasma*), Withers from a more paleontological and also morphological point of view from a *Scalpellum*-like barnacle. *Trilasmis* (*Poecilasma*) and *Lepas* are in his opinion descendents from *Oxynaspis*.

It may here be of interest to comment on the interesting discovery of *O. connectens* which shows a "curious intermingling of characters from different genera" (Broch, 1931 p. 37). After studying my new species *O. pulchra*, as well as other earlier known ones, I should like to express my opinion about the whole genus in the words cited above from Broch. From a study some years ago of the *Oxynaspis* in the British Museum, London, I came to the opinion that some species of *Oxynaspis* show a superficial resemblance to some *Octolasmis* species for instance *O. sessilis*. This will perhaps speak for a connection with the genera *Trilasmis* and *Octolasmis*. But other species *e.g. O. celata* also show a relation to *Scalpellum* a fact first pointed out by Darwin.

If we study the 8 now known species we cannot say that in the capitular valves they wholly agree as *e.g.* in the position of the umbo. The terga of the different species agree fairly well which is the case in nearly all pedunculates. The scuta represent in the various species different stages of development. As regards the situation of the umbo of the scutum it varies from nearly central to subcentral but is in no case basal. The carina in *Oxynaspis celata* has the umbo nearly central. Below the umbo there is a plate-shaped part not much forked. In the

species *O. patens, terrae-novae, aurivillii* and *pacifica* the umbo is subcentral and the lower part is very similar in shape to that in *O. celata*. In *O. aurivillii* there is already the beginning of a furca in the carina. In *O. bocki* there is a carina more agreeing with the *Trilasmis—Octolasmis* series. Thus the umbo is nearly basal. The part below the umbo is forked. In this character *O. pulchra* n. sp. is associated. As regards Broch's *O. connectens* I was first doubtful if as regards the carina it should be put in the first or second group as the carina shows according to Broch "an attempt at forking." But by a study of the type specimen I was led to include it with the former. The species name *connectens* is also in this regard well found as the carina, with its nearly basal umbo but flattened lower part, links the two types together. Also this speaks in favour of an opinion that the genus though only comprising a few species is rather split. As regards the internal parts our knowledge of the filamentary appendages is incomplete. But the filamentary appendages at the base of cirrus I. seem to be present in *O. celata* (according to Totton, 1923), *terrae-novae* and *connectens*. In the new species, *O. pulchra*, they are not found as is also the case in *O. bocki, aurivillii* and *pacifica*. Certainly this appendage is not developed in all species. In the genus *Lepas* for instance some species have many filamentary appendages, others only one or none. The differences in the appendages between the species of *Oxynaspis* do not support the division into two groups here made from a study of the carina only. These groups in my opinion certainly do not represent subgenera. The bosses and protuberances on the inside of the first cirri are only seen in the species *O. terrae-novae* and *O. pulchra* n. sp. They may have been overlooked in some of the other species, but their presence in representatives of the two mentioned groups unites those in this regard. The discovery of dorsal filamentary appendages (one in *O. connectens* and two in an unnamed species mentioned by Totton, 1923) points, according to Broch to affinities with *Megalasma*. But these appendages are not, as was mentioned above, present in the species in the present collection. We thus see that it is very difficult to come to a general conclusion about the phylogeny as it is not possible to draw any definite conclusion from this analysis. Nevertheless it has been of interest to point out some facts which will perhaps give directives for further studies on richer material. My earlier diagnosis of the family *Oxynaspidae* needs revision, which will be left until more is known of the different species.

Addition: Some days before this paper was sent to the printer I got an interesting paper on two new Japanese cirripeds by F. Hiro (1933), which paper will be of great interest in this connection, as it contains a discussion of phylogenetical problems

of pedunculate cirripeds. Much in this paper speaks for the opinions pronounced by me in my earlier papers. The view of F. Hiro on the genus *Oxynaspis* may here be cited: (p. 243) "Of the pedunculate cirripeds, the *Lepadidae* (s. str.) which have naked peduncles, are considered to have been derived from the Scalpellid group by the loss of the lower lateral valves of the capitulum and the scales of the peduncle, through *Oxynaspis* which is regarded as the more ancient form of the *Lepadidae* (s. str.)" and (p. 244) "Obviously, this *Oxynaspis*, or its allied forms, has given rise on the one hand to the recent *Poecilasma* and *Lepas* which have the valves wholly calcified and the umbones of the scutum and carina basal in position, and on the other hand to such forms as *Conchoderma* and *Alepas*, in which the valves are decalcified and degenerate, but the umbo of the scutum remains subcentral. It is noteworthy in this case that *Poecilasma* and *Lepas* have no doubt arisen independently, since, although externally they are similar to each other, internally *Lepas* is decidedly more related to *Conchoderma* and *Alepas* than to *Poecilasma*." As I have also pointed out above there must be a connection between the genera *Scalpellum, Oxynaspis, Trilasmis* (*Poecilasma*) and the allied *Octolasmis* and *Megalasma*. It may be possible that *Oxynaspis*, which genus, as treated above in this paper, is rather split though only comprising a few species, has given rise to such different series as *Trilasmis* (*Poecilasma*) and allied forms and *Lepas* and its allies. But as we know too little of the fossil forms of these genera especially *Oxynaspis*, I have preferred as in my earlier papers not to construct a phylogenetical tree, which must always be a rather dubious thing.

Above I have, as in my earlier papers (1921 and 1925), pointed out that it seems not to be suitable to take up such different genera as *Lepas, Heteralepas, Oxynaspis, Trilasmis* and allied genera under the same family as done by Broch (1922 and 1931). In this paper by F. Hiro p. 244 a similar opinion, which may be cited, is found: "Broch (1922) also is rather against the view that the *Lepadidae* (s. str.) should be split up into small groups. But it seems to me advisable to subdivide the family, to consider the phylogenetic relationship of the different forms included in it."

Family LEPADIDAE (Darwin) Nilsson-Cantell.

Genus **Lepas** Linné 1767.

Lepas anserifera Linné, 1767.

New locality: Butang Archipelago, Peninsular Siam, 1911.

Several typical specimens with 6 filamentary appendages on cirrus I.

Distribution: Pelagic in tropical and temperate seas.

Family HETERALEPADIDAE Nilsson-Cantell, 1921.

Genus Heteralepas Pilsbry, 1907.

Heteralepas (Heteralepas) gigas Annandale, 1905.

Alepas gigas Annandale, 1905.

Heteralepas gigas Annandale, 1916.

This species, characterized by its large size, is here represented by a specimen from the same locality as given by Annandale (1916), who also has studied similar specimens from the Raffles Museum. It is indeed a difficult thing to make out if all the species of the genus *Heteralepas* are good ones. Regarding this one it is possible that it only represents older specimens of another earlier known species. But because it is possible to identify Annandale's species there is no reason not to regard it as a separate species. To the description of the internal parts given by Annandale (1905) nothing need here be added.

Locality: 10° 22′ 30″ S. Lat., 120° 7′ 30″ E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13.1° C. One specimen together with *Sc. persona*. (Earlier reported on by Annandale, 1905, 1916).

Distribution: Malay Archipelago.

Heteralepas (Heteralepas) japonica (C. W. Aurivillius, 1894).

Syn. Nilsson-Cantell, 1927.

Several specimens of the genus *Heteralepas* must in my opinion be referred to *H. japonica*, a species critically studied as regards synonyms by the author (1927). In the long peduncles the individuals agree with the forma *indica* of *japonica*. Concerning this species there is a study by Nilsson-Cantell (1927, p. 756): "*H. indica* is therefore only included here as a forma *indica* of *japonica*, and then concerns individuals with long peduncle. Possibly this variation need not be specially treated of in a future revision."

An examination of the internal parts shows, as stated by the author (1929), that the supposed difference between *H. japonica* and *indica* in the number of segments of the shorter rami of cirrus V. and VI. is not sufficient to distinguish those species.

Locality: 10° 22′ 30″ S. Lat., 120° 7′ 30″ E. Long. *Depth:* 238–915 m. *Bottom temp.:* 13.1° C. This locality is already noted by the author 1927 for specimens in the Netley Hospital collection.

Distribution: Japanese-Malayan waters, Indian Ocean (eastern and western parts).

Heteralepas (Paralepas) lithotryae (Hoek, 1907). Text-fig. 2.

Alepas lithotryae Hoek, 1907.

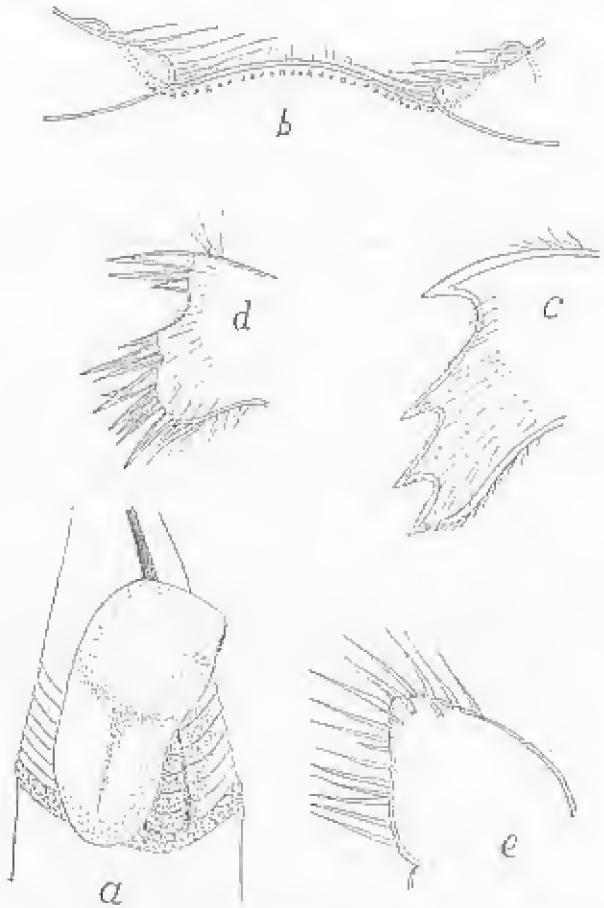
Discussion and supplementary description: The subgenus *Paralepas* of the genus *Heteralepas* is well defined from the subgenus *Heteralepas* by the shape of the cirri. Several species of the former subspecies have now been described. Their identification seems to offer considerable difficulty as the differences are not very great. It must thus be rather doubtful if all are good species, described as they are from one or few specimens. But I think it is better to follow Broch who, with some hesitation, has described (1922) 4 new species on rather small differences, than to try to rank them under earlier known species, which will obscure further identifications. In this collection there was a small Heteralepas specimen situated on the scutum of a *Lithotrya nicobarica* from the Malay Archipelago. The specimen in the present collection agrees well with a specimen also from *L. nicobarica* from the same region, which is described by Hoek (1907) under the name *Alepas lithotryae*. As pointed out by the author (1927) this species belongs to the subgenus *Paralepas*. In the following supplementary description reasons for this determination are given.

The fact that both Hoek's specimens and this one are taken from *L. nicobarica* in Malayan waters suggests that they possibly are identical, as no other *Paralepas* have been taken from that substratum.

As in Hoek's specimen there is no well-defined limit between the capitulum and the peduncle, as seen from the figure here given. The figure given by Hoek is not quite similar to mine here, but this may be due to differences in contraction of the musculature by the preservation or to differences in age. No carinal crest is to be seen. The orificium is extremely narrow, as in the type, and not protuberant. No scuta are present but they are indicated in the chitin. The carinal margin of the capitulum is strongly bowed. The occludent border is a little convex beneath the orifice. In Hoek's specimens the surface has a reticulation of delicate striae not seen in my specimen which has a smooth cuticle, certainly this is also a character due to contraction of the animal. The peduncle is here of about the same length as the capitulum without any well-defined limit. As seen from the figure (Text-fig. 2) there is a slight longitudinal depression on the peduncle and a similar one between capitulum and peduncle due to contraction during preservation.

Measurements of the specimen in mm.:

Length of capitulum	..	..	4
Breadth of capitulum	..	..	4
Length of peduncle	..	..	4.5
Breadth of peduncle	..	..	3.3



Text-fig. 2. *Heteralepas (Paralepas) lithotryae* (Hoek, 1907). a. Specimen, lateral view. b. Labrum with palpi. c. Mandible. d. Maxilla I. e. Maxilla II.

As will be seen the type specimen is much smaller, the largest measuring only 4.5 mm. in total length. Perhaps in these small specimens the peduncle has not attained its normal shape.

Internal parts: A study of the mouth-parts and cirri give good agreement. But as the preservation of the interior of the animal was not very good I was not able to compare the filamentary and caudal appendages nor the penis, which parts are well-known according to the type description.

The labrum has small chitinous teeth and delicate hairs.

The palpus is short and conical with bristles along the margin and at the tip.

The mandible has three teeth and a tooth-like inferior angle. The small spines mentioned by Hoek along the upper margin of teeth 2 and 3 as well as the upper margin of the inferior angle are also found here. Also along the lower margin of the same teeth small additional teeth are placed.

The maxilla I. has two strong spines above the rather distinct notch, with few hairs. Below the notch there are strong spines arranged in double rows. Earlier I have discussed the differences between the mouth-parts of different genera of cirripedia. In this study I have found that the maxilla I. of these two subgenera are slightly different, *Heteralepas* having the lower part more prominent than *Paralepas*, but it can also be stated that the differences are not so important in this respect as there are sometimes transitional forms between the two. Broch also mentions (1922) two types: The subgenus *Heteralepas* with the notch more distinct and the subgenus *Paralepas* with a small or rudimentary notch, the differences being due to the more or less projecting lower part of the front margin of the maxilla. In the species *H. lithotryae* and *H. dubia* Broch, 1922, of the subgenus *Paralepas* the notch is broad and the lower part projecting as in the subgenus *Heteralepas*. This shows that as regards the maxillae there are no great differences between these subgenera, which are however in other respects well separated.

The maxilla II. has the front edge straight to convex with a continuous row of long spines continuous with the spines on the rounded extremity and the front part of the upper margin.

Number of segments of the cirri:

I		II		III		IV		V		VI		Caudal appendage
6	6	7	8	8	7	8	8	6	6	6	6	Lost

The cirri are extremely short and in this species nearly straight as asserted by Hoek. The first pair shorter than the following agreeing in details with the original description. The

following cirri have nearly equal rami. The distal segments have strong clawlike spines of importance for catching the food, because the cirri from their shortness are unsuitable. As in the type specimens the cirri V. and VI. are shorter than the foregoing. The caudal appendages in the specimens of this collection were lost. According to Hoek they are a little longer than the pedicel, having five segments. The penis is also lost but has, according to the original description, spines of peculiar shape.

According to Hoek the type specimens were attached to the valves (Text-fig. 2) even on their inside, thus being a source of inconvenience to the host. This specimen was placed on the outside of the left scutum near to the orificium, a good place indeed for catching the planktonic food of the *Lithotrya*.

Hoek speaks about the relation of this species to *Heteralepas quadrata*, but since the revision of the old genus *Alepas* by Pilsbry this does not hold good as *H. lithotryae* is a typical *Paralepas* and *A. quadrata* a typical *Heteralepas*.

New locality: Christmas Island, Indian Ocean, Oct. 1932.

Old locality: 2,700 m. N. 185° E. from south point of South Lucipara Island.

Family TRILASMATIDAE n. nom.[1]

(= fam. *Poecilasmatidae* Annandale, 1909, Nilsson-Cantell, 1921).

Genus **Octolasmis** Gray, 1825.

Octolasmis warwicki (J. E. Gray, 1825).

Syn. Nilsson-Cantell, 1928.

During a study of a large collection of Cirripeds belonging to the Amsterdam Museum much material of *O. warwicki* from several localities in the Malay Archipelago was registered. In a paper by the author on this material, not yet in print, the question whether *O. warwicki* and *O. nierstrassi* are good species is discussed. As it is possible to distinguish them, especially by the rather different shape of the terga, they must be kept as distinct species.

One specimen from the cheliped of a living *Portunus pelagicus* may be noted as it is one of the largest I have seen, measuring in the length of capitulum 10 mm., in breadth of capitulum 7 mm., in length of peduncle 2.5 mm. and breadth of peduncle 3.5 mm.

1. According to Pilsbry (1928) the genus name *Poecilasma* is rejected and the older name *Trilasmis* taken up. Consequently the family name must be changed to *Trilasmatidae*.

New localities: Tanah Merah, Singapore, 1909. The specimens were found attached to a crab.

Siglap, Singapore, June 1933. One specimen on the cheliped of *Por unus pelagicus*.

Distribution: South China Sea to Indian Ocean.

Octolasmis nierstrassi (Hoek, 1907).

Syn. Nilsson-Cantell, 1927.

New locality: 5° 59′ 6″ N. Lat., 99° 8′ 33″ E. Long. *Depth:* 73 m. *Bottom temp.:* 25° C. *Bottom:* Dark gray mud.

Specimens are attached to a red alcyonarian and to *Balanus ciliatus*.

Distribution: Malay Archipelago, Persian Gulf, Japan.

BALANOMORPHA Pilsbry

Family BALANIDAE Gray.

Subfamily BALANINAE Darwin.

Genus Balanus da Costa, 1778.

Subgenus Balanus da Costa.

Balanus amphitrite variegatus Darwin, 1854.

This species, originally described from specimens from New Zealand, recurs and is discussed in the afore mentioned paper by the author on Malayan cirripeds, which is not yet in print. Hoek also mentions in the Siboga expedition specimens of *B. amphitrite* showing resemblance to *variegatus*. The most typical character is the violet coloured narrow stripes on the shell crossed by white bands. This variety is rather near to *B. a. cirratus*, though the colouring is different.

There are also in the opercular valves no great differences in these subspecies. In the specimens dissected I found on the scutum a distinct but short adductor ridge. The spur of the tergum is rather elongated as in *cirratus*, in some specimens it is pointed, in others more truncated. The opercular valves of *B. a. variegatus* from the Malay Archipelago will be figured in the above mentioned paper of mine.

New localities: Seletar, Singapore. Specimens on *Ostrea* shells. Singapore. Littoral. Specimens on mussel shells.

Distribution: New South Wales, New Zealand, Malay Archipelago.

Balanus amphitrite cirratus Darwin, 1854.

This subspecies has been discussed by the author in several papers (Nilsson-Cantell, 1921, 31 b, 32), and is here represented by one specimen, pale in colour, thus agreeing with some specimens from China (Nilsson-Cantell, 1931 b) and some other smaller specimens of the typical purplish brown colour. The opercular valves of the specimens are exactly like those figured by the author (Nilsson-Cantell, 1921, Text-fig. 65 c, d).

New locality: Singapore. Littoral. Some specimens situated on a mussel shell together with *B. a. variegatus*, other smaller ones on wood.

Distribution: Mouth of Indus, Further India, Sunda Islands, Philippines, China and Australia.

Balanus amphitrite poeciloscupta Broch, 1931, Plate V, fig. 4, Text-fig. 3, 4.

Some specimens of a *Balanus* situated on a gorgonian stem agree wholly with the recently described forma *poeciloscupta* of *B. amphitrite*. If we wish to avoid the trouble which is caused by the great difficulty in identifying the many subspecies of *B. amphitrite* it is necessary to give figures especially of the opercular valves. In studying the collection of the Siboga expedition in Amsterdam, one must note that many rather different forms are included in the two varieties *communis* and *malayensis* of Hoek. If consequently for instance a specimen is taken up under the name *B. amphitrite malayensis* and no figures of the opercular valves and the shell are given it is not possible for later investigators from the literature only to know the exact appearance of the specimen. To avoid mistakes figures are here given showing the entire agreement with those given by Broch. In the Siboga material I have seen specimens rather like these but ranged under *B. a. malayensis*. Another species, *B. minutus* Hoek, 1913, re-identified by Broch, 1922 and Nilsson-Cantell, 1925, is rather like *B. a. poeciloscupta* but well distinguished by the shape of the opercular valves. Perhaps *B. minutus* is only a Malayan form of *B. amphitrite*, an opinion expressed by Broch, 1922, p. 320.

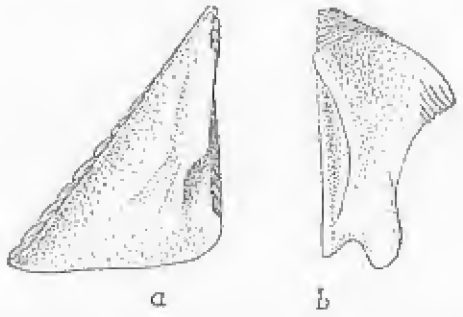
In the individuals here dealt with the shell is laterally compressed. The specimens, which are fixed on a rather thin gorgonian stem, have consequently the bases externally concave taking their form from the substratum.

Measurements of some specimens in mm.

Carino-rostral length			*Height*
6	..	..	.. 4.6
6	..	..	.. 5.1
7	..	..	.. 5.5

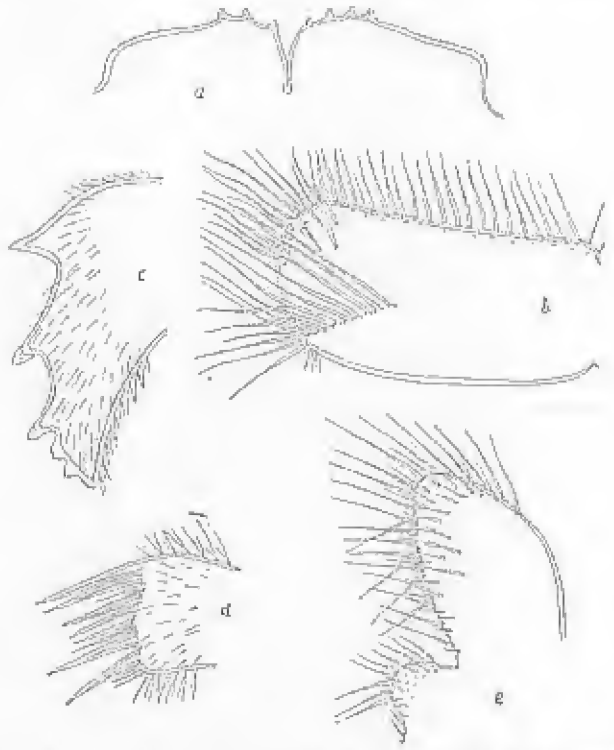
These specimens are thus smaller than those studied by Broch, who mentions a carino-rostral length of 10 and 8 mm. respectively. As I found eggs in initial development the specimens are mature. This form certainly attains no large size.

The markings on the shell are rather typical, as seen from the photographs here given, showing good agreement with Broch's figure. The compartments are porous like the basis, a condition typical for all species belonging to this section of *Balanus*. The radii are exceptionally broad, sometimes coloured in the same way as the compartments. The opercular valves agree completely with the figures given by Broch as seen from text-fig. 3 which is exactly like a copy of Broch's. The scutum has only a weak indication of an adductor ridge, otherwise internally no sculptures.



Text-fig. 3. *Balanus amphitrite porcilosculpta* Broch, 1931.
a. Right scutum. b. Right tergum.

Internal parts: The mouth-parts may here be described and figured. The labrum has according to Broch three teeth on each side of the notch. On dissecting two specimens I found in one 3 teeth on one side and 4 on the other, in the second specimen 4 teeth on each side of the notch. Variation in this respect is rather common in several species of *Balanus*. The palpus is typical, being clubshaped.



Text-fig. 4. *Balanus amphitrite porcilosculpta* Broch, 1931.
a. Labrum. b. Palpus. c. Mandible. d. Maxilla I. e. Maxilla II.

The mandible and the maxillae are of the common type, as stated by Broch. In maxilla I. I found in these specimens a small hardly distinguishable notch. Figures are given for comparison.

Number of segments of the cirri:

Size	I		II		III		IV		V		VI	
Carino rostral length 5 mm. .. Height 5·1 mm.	9	13	10	11	10	11	19	21	23	24	25	26

As no notes are given in the original description concerning the numbers of segments a comparison is impossible. But I believe there is no great difference in this respect. The armature

of the third cirrus mentioned by Broch is here also traced. The longer cirri have 3 pairs of strong spines and sometimes a fourth pair of very small spines on the front edge of the segments.

New locality: 1° 25' 3" N. Lat., 102° 58' E. Long. *Depth:* 33 m. *Bottom temp.:* 21° C. *Bottom:* Grey mud. The specimens were collected on cable from C.S. "The Cable". 11-2-33.

Distribution: Malay Archipelago, South China.

Balanus amphitrite rafflesi n. subsp. Plate V, fig. 5, 6, Text-fig. 5, 6.

Diagnosis: Shell originally smooth with longitudinal violet stripes, without horizontal bands. Older specimens more corroded without stripes and of a gray colour. Radii well developed with oblique summits, in older specimens more oblique due to denudation. Compartments well calcified, remarkably thick. Scutum with a strong articular ridge and adductor ridge extending from the apex over a large part of the valve. Cavity for the adductor muscle deep. Below the adductor ridge there are two smaller ridges, the lower near to the very indistinctly marked pit for the lateral depressor muscle. Tergum externally with a slight broad longitudinal furrow. Spur well developed, rounded. Labrum with four teeth, the first placed in the notch. Maxilla I. without distinct notch below, not much projecting. Cirrus III. with small teeth on the front edge of the segments. Longer cirri with four pairs of spines on the front edge of the segments.

Description: Some specimens of a *Balanus* situated on mangrove from Pulau Sakra, near Singapore seem on a superficial examination not to belong to any of the already described subspecies of *B. amphitrite*, to which species they belong as seen on an examination according to the key given by Pilsbry (1916). After a more careful study of them I must regard them as a new subspecies as they do not agree with any other known subspecies. As earlier pointed out (Nilsson-Cantell, 1921) I cannot agree with Hoek in uniting the Malayan forms under the two varieties (sensu Hoek) *communis* and *malayensis*. A study of his material in Amsterdam shows that there are many different forms included in those varieties. I think it is best to give an exact description of this subspecies to facilitate further identifications. The differences in the characters are indeed not very important but if they are summed up they are sufficient to institute a new subspecies.

Measurements of some specimens in mm.

	carino-rostral diam.	*height*
holotype ..	23.5	12
paratype ..	12	6
paratype ..	21.5	16

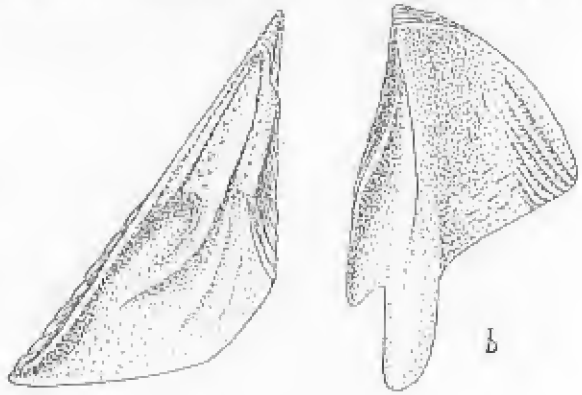
From this it appears that this subspecies can attain considerable size. Photographs are given to make it possible to identify them later. A smaller paratype was of interest as showing better than the larger specimens the original colour of the wall, which is smooth with violet longitudinal stripes on a lighter and somewhat red coloured ground. The stripes are not crossed by horizontal bands. In this the variety agrees with several subspecies of *B. amphitrite*. In the older specimens the colour and stripes are hardly seen, as the wall is rather corroded. The colour seems now to be grey. The shell is conical with a large rhombiform orificium generally toothed. The compartments are very strongly calcified and thick. The tubes are not much filled up, having in the upper parts transversal septa. Interior ribs of the parietes all continuous with septa in the wall.

The radii in the small specimen are well developed with the upper summit oblique. In the older specimens the radii are more corroded especially in the upper part. They thus seem to be rather narrow, which in reality is not the case.

The alae are of the typical shape and like other parts of the wall thick. The basis is thick and porous at least in the radial part.

The opercular valves are thick like the compartments.

The scutum has externally distinct growth-ridges not very strongly marked. Internally the scutum is very strongly sculptured, a characteristic feature for this species. The articular ridge is very strongly developed, about half the height of the valve, sometimes shorter. The adductor ridge is also very

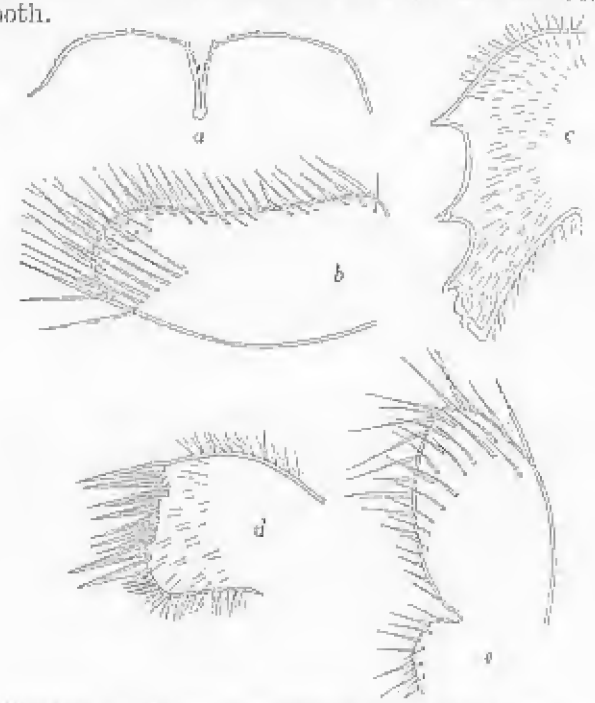


Text-fig. 5. *Balanus amphitrite rafflesi* n. subsp.
a. Right scutum. b. Right tergum.

strongly developed, extending up to the apex of the scutum. A small furrow is seen between the two ridges. The pit for the lateral depressor muscle is marked by a very small ridge, and is thus rather indistinct. Below the adductor ridge a shorter ridge is seen. This little ridge is traceable in several subspecies of *B. amphitrite*.

The tergum externally has growth-ridges and a slight longitudinal depression not folded in. The spur is well developed, sometimes a little shorter than is figured for the holotype. The extremity of the spur is rounded off, its width about a fourth of the basal margin of the tergum, a measurement given by Darwin for the species. This is however, as pointed out by Darwin, a variable character as measurements up to a third are found in some subspecies. The articular ridge is also here strongly developed. The articular furrow is deep as in the scutum. The crests for the depressor muscle are moderately developed. The tergum thus differs from what I earlier found in *B. a. communis*, to which these specimens come nearest.

Internal parts. Labrum with three teeth on each side of the notch. The teeth are not very strongly developed in the specimens dissected. On both sides of the notch there is moreover a small tooth.



Text-fig. 6. *Balanus amphitrite raffesi* n. subsp.
a. Labrum. b. Palpus. c. Mandible. d. Maxilla I. e. Maxilla II.

The palpus is typical clubshaped with a distal longitudinal row of long spines externally. I do not consider the differences mentioned by Hoek (1913) between the var. *communis* and *malayensis*, the former with one row of distal spines the latter with a double row of such spines, of great systematic value. I have not in my studies of several subspecies of *B. amphitrite* found these differences between the palpi.

The mandible has three strong teeth and two smaller ones, the fifth confluent with the lower angle. Teeth 2 and 3 are double. The other mandible has the teeth less distinctly marked, a difference which is due to detrition. A study of specimens which have newly cast off the old chitinous cover, shows more distinct, teeth, a feature which must be attended to in systematic studies on this group.

The maxilla I. has a rather straight edge, i.e. the lower part of the front edge is not very projecting but provided with stronger teeth. The notch below the upper spines is scarcely distinguishable.

The maxilla II. is of the shape typical for *Balanus amphitrite*.

If these specimens should be included under one of the varieties of Hoek it is not easy from the mouth-parts to decide under which. The palpus agrees according to Hoek with var. *communis*, the maxilla I. more with var. *malayensis*. Judging by external characters there are also similarities to both varieties of Hoek.

Number of segments of the cirri of the holotype:

I		II		III		IV		V		VI	
14	32	16	16	17	18	32	28	..	36	..	36

The number of segments in this large holotype is a little higher than that stated by Hoek, for *B. amphitrite*, certainly depending on the fact that Hoek studied individuals of smaller size. The small recurved teeth on the front edge of the cirrus III. often found in *Balanus amphitrite*, as in other species, is also present here but the teeth are not so strong. The longer cirri have four pairs of spines on the front margin of the segments.

Locality: Pulau Sakra, near Singapore. Specimens on mangrove. May, 1933.

Subgenus Chirona Gray

Balanus amaryllis Darwin, 1854 forma euamaryllis, Broch, 1922.

New locality: 5° 59′ 6″ N. Lat., 99° 8′ 33″ E. Long. *Depth:* 73 m. Bottom temp. 25° C. Bottom: Dark grey mud. Large specimens adhering to a cable, with *B. ciliatus* situated on the wall. Collected from C. S. "The Cable". 9.2.33.

Distribution: Malay Archipelago, Indian Ocean, Japan, China, Northern coast of Australia.

Subgenus Solidobalanus Hoek, 1913.

Balanus ciliatus Hoek, 1913. Plate V, fig. 7, Text-fig. 7.

Balanus ciliatus Hoek, 1913, Nilsson-Cantell, 1925, Broch, 1931.

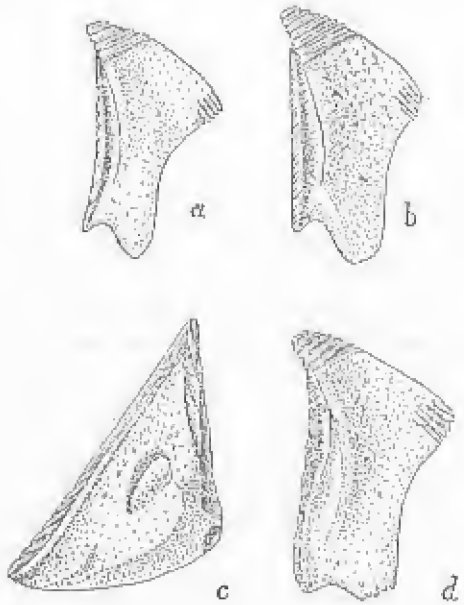
Supplementary description: This species is described by Hoek in the Siboga Expedition from individuals of a rather small size. Later on the species is dealt with by Nilsson-Cantell, 1925. The largest specimen of this collection from the Raffles Museum, Singapore measured 8.3 mm. in carino-rostral diam. Broch, 1931, described individuals with a diameter of 7 mm. The present collection contains individuals of different ages and seems to me to be the best made up to now. This species thus attains the ordinary size of *B. amphitrite.*

Measurements of some specimens in mm.:

Carino-rostral length	*Height*
6	3.5
12	13.
15	7.
13	9.

The colour of the specimens is nearly white. Sometimes as stated by Hoek light reddish, with the typical vertical narrow red stripes. The radii in these specimens are white, in Hoek's description "more or less distinctly orange-coloured." This may be a variable character as I (1925) found specimens with the radii white or coloured.

The structure of the compartments is as stated in the type description. Thus the parietes, radii and basis are without pores. The radii are broad with oblique summits. The internal surface of the thick compartments has strongly developed longitudinal ridges.



Text-fig. 7. *Balanus ciliatus* Hoek, 1913.

a, b, d. Right terga. c. Right scutum.

The opercular valves: The scutum of these specimens agrees wholly with the description earlier given. Figures are given for comparison. In older specimens the pits for the adductor and lateral depressor muscles can be traced. The adductor ridge is rather indistinctly marked.

The tergum has a spur showing some variation due to age. In younger individuals it is rather pointed, in older ones more rounded with small tooth-like projections. (Compare also Nilsson-Cantell, 1925). For further identifications some figures are given.

Internal parts: The mouth-parts agree in all particulars with the description given by Hoek, 1913 and Nilsson-Cantell, 1925. The same is also established as regards the cirri. Because these individuals are of larger size it is to be expected that the number of the segments especially in the longer cirri will be greater.

A comparison between specimens from this collection and Hoek's may be of interest.

——	Size	I		II		III		IV		V		VI	
Raffles Museum Collection	Carino-rostr. length 11 mm. height 8.5 mm.	10	19	11	12	13	14	25	26	24	25	27	27
Siboga Collection	Smaller specimen	7–9	14	7	9	11	12	..	..	..	..	22	22
"	Larger specimen	8–9	14	10	11	11	13	16–17	19–20	19	20	24	..

It is of interest to note the presence of small recurved teeth on the front edge of the segments of the cirrus III. They are also established for cirrus IV. These teeth are not found in *B. auricoma*. Broch (1931 p. 72) says with regard to this character the following: "Nilsson-Cantell (1925) expresses his doubt as to the validity of the two species (*B. auricoma* and *ciliatus*) although he himself, after examination of *B. ciliatus*, emphasizes the existence of "nach unten gerichtete Zähne" in the longer ramus of the third cirrus, and says that "solche werden nicht bei *B. auricoma* angegeben. This evidently must be looked upon as a decisive specific character." I hold it not impossible that the two species are distinctly separated, but I do not think the absence of these teeth on the cirri is a character of great specific value. On studying several species of the genus *Balanus* one must note that these teeth on cirri III. and IV. are rather common in several species though very differently developed. Possibly the teeth may be better developed in older specimens. Perhaps also there exists a relation between the presence of these teeth in some individuals and an environment in which the orificium can easily be overgrown,—a feature of interest for investigators, who are able to study the species alive in their natural surroundings. In some specimens of this collection the wall is partly covered by sponges. In the very small specimens studied by me (1925) the teeth are very rarely developed.

New locality: 5° 59′ 6″ N. Lat., 99° 8′ 33″ E. Long. *Depth:* 73 m. *Bottom:* Dark gray mud. *Bottom temp.* 25° C. Several specimens adhering to a cable, some fixed on *B. amaryllis euamaryllis*. On some specimens smaller *Octolasmis nierstraszi* were situated. Collected from C. S. "The Cable". 9-2-33.

Distribution: Malay Archipelago, Japan.

Subfamily TETRACLITINAE Nilsson-Cantell, 1921.

Genus Tetraclita Schumacher, 1817.

Tetraclita porosa viridis Darwin, 1854.

Syn. Nilsson-Cantell, 1921.

New localities: Raffles Lighthouse, Singapore. Coll. 1898. Three specimens.

Butang Archipelago, Peninsular Siam. Two specimens on a Patellid.

Distribution: Difficult to state exactly. Known from West Indies (Broch, 1922), Japan, China, Malay Archipelago, Australia, West Africa ? (Pilsbry, 1916).

Subfamily CHELONIBIINAE Pilsbry, 1916.

Genus Chelonibia Leach, 1817.

Chelonibia patula (Ranzani, 1818).

New locality: Raffles Lighthouse, Singapore. Coll. 1898. Two specimens.

Distribution: Mediterranean, Atlantic, Malay Archipelago, Australia.

LITERATURE

Annandale, N., 1905. Malaysian Barnacles in the Indian Museum with a list of the Indian Pedunculata.—Mem. Asiat. Soc. Bengal. Vol. I. Calcutta.

————, 1908. Illustrations of the Zoology of the R. I. M. S. Ship "Investigator" Crust. Ent. Pt. Pl. III. Calcutta.

————, 1909. An account of the Indian Cirripedia Pedunculata. Pt. I, Fam. Lepadidae (s. str.)—Mem. Ind. Mus. Vol. II., No. 2. Calcutta.

————, 1914. New and interesting Pedunculate Cirripedes from the Indian Seas.—Rec. Ind. Mus. Vol. X. Calcutta.

————, 1916. Barnacles from deep-sea telegraph cables in the Malay Archipelago.—Journ. Straits Branch Roy. Asiat. Soc. No. 74. Singapore.

Aurivillius, C. W. S., 1894. Studien über Cirripedien.—K. Sv. Vet. Akad. Handl. Stockholm, 1893. Bd. XXVI, No. 7. Stockholm.

Broch, Hj., 1922. Papers from Dr. Th. Mortensen's Pacific Expedition 1914–16 X. Studies on Pacific Cirripeds.—Vidensk. Meddel. Dansk. naturh. Foren., Bd. 73. Odensee.

———, 1931. Papers from Dr. Th. Mortensen's Pacific Expedition 1914–16. LVI. Indonalayan Cirripedia.—Ibid. Bd. 91. Kobenhavn.

Calman, W. T., 1918. On barnacles of the genus *Scalpellum* from deep-sea telegraph cables.—Ann. Mag. Nat. Hist. Ser. 9, Vol. I. London.

Darwin Ch., 1851. A Monograph on the sub-class Cirripedia. I. Lepadidae. London.

———, 1854. Ibid. II. The Balanidae, Verrucidae etc. London.

Gruvel, A., 1905. Monographie des Cirripèdes ou Thécostracés. Paris.

Hiro, F., 1931. Notes on some new Cirripedia from Japan.—Mem. Coll. Sci., vol. VII B, no. 3. Kyoto.

———, 1933. Notes on two interesting pedunculate Cirripeds, *Malacolepas conchicola* n. gen. et sp. and *Koleolepas avis* (Hiro), with remarks on their systematical position.—Ibid. vol. VIII B, no. 3. Kyoto.

Hoek, P. P. C., 1888. The Cirripedia of the Siboga-Expedition. A. Pedunculata. Siboga-Expeditie. Monogr. XXXIa. Leiden.

———, 1913. Ibid. B. Cirripedia sessilia.—Ibid. Monogr. XIIIb. Leiden.

Nilsson-Cantell, C. A., 1921. Cirripeden-Studien.—Zool. Bidr. fr. Uppsala. Bd. VII. Uppsala.

———, 1925. Neue und wenig bekannte Cirripedien.—Ark. Zool., Bd. 18 A. Stockholm.

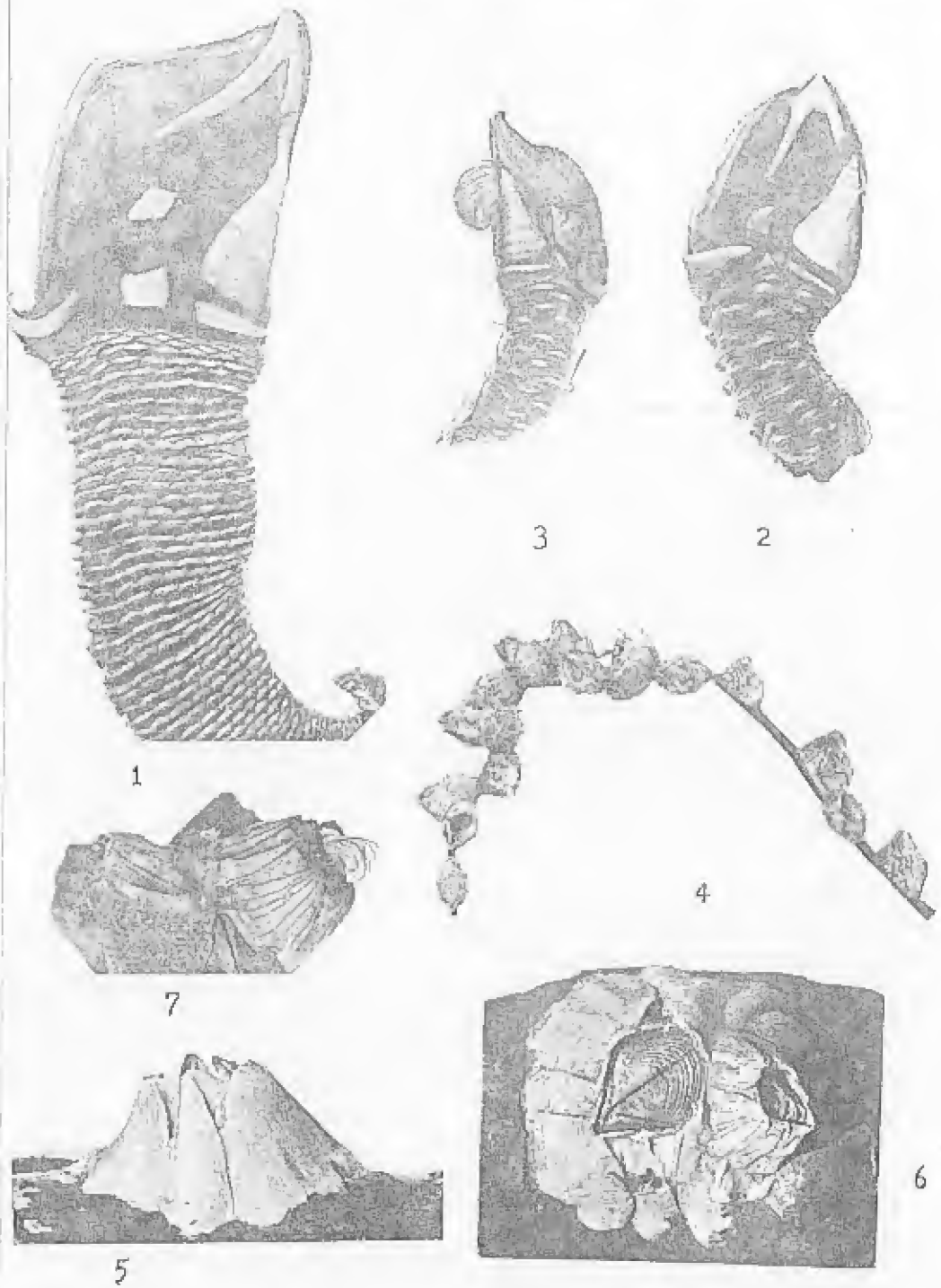
———, 1927. Some Barnacles in the British Museum (Nat. Hist.)—Proc. Zool. Soc. Pt. 3. London.

———, 1928. Studies on Cirripeds in the British Museum (Nat. Hist.).—Ann. Mag. Nat. Hist. Ser. 10, Vol. II. London.

———, 1931 *a*. Cirripeds from the Indian Ocean and Malay Archipelago in the British Museum, (Nat. Hist.) London.—Ark. Zool., Bd. 23 A. No. 18 Stockholm.

———, 1931 *b*. Revision der Sammlung recenter Cirripedien des Naturhistorischen Museums in Basel.—Verh. naturf. Ges. Basel Bd. 42. Basel.

———, 1932. Cirripedes (Addt. part)—Résultats scientifiques du Voyage aux Indes Orientales Néerlandaises de S. A. R. le Prince Léopold de Belgique.—Mém. Mus. Hist. nat. Belg. Hors Ser. Vol. III, No. 10. Bruxelles.



Indo-Malayan Cirripeds.

———, 1933. Zoologische Ergebnisse einer Reise nach Bonaire, Curacao und Aruba im Jahre 1930. No. 12. Cirripeds from Bonaire.—Zool. Jahrb. Syst. Bd. 64. Hft. 3/5. Jena.

Pilsbry, H. A., 1907. The Barnacles (Cirripedia) contained in the collections of the U. S. National Museum.—Smithson. Inst. U. S. Nat. Mus., Bull. 60. Washington.

———, 1916. The sessile Barnacles (Cirripedia) contained in the collections of the U. S. National Museum, including a monograph of the American species.—Ibid. Bull. 93. Washington.

———, 1928. Littoral Barnacles of the Hawaiian Islands and Japan.—Proc. Acad. Nat. Sci. Phil., vol. LXXIX, 1927. Philadelphia.

Sewell, S. B. S., 1926. A study of *Lithotrya nicobarica* Reinhardt.—Rec. Ind. Mus. Vol. XXVIII, Pt. IV. Calcutta.

Stebbing, T. R. R., 1900. On crustacea brought by Dr. Willey from the South Seas.—Zool. Results based on material from New Britain, New Guinea, Loyalty Islands and elsewhere 1895-97. Part V. Cambridge.

Totton, A. K., 1923. Antipatharia (and their cirripede commensals).—Brit. Mus. (Nat Hist.), Brit. Antarct. ("Terra Nova") Exp. 1910. Nat. Hist. Rep. Zool. V. No. 3. London.

Withers, T. H., 1928. Catalogue of Fossil Cirripedia in the Department of Geology, vol. I. Triassic and Jurassic. Brit. Mus. (Nat. Hist). London.

EXPLANATION OF PLATE V

Fig. 1. *Scalpellum stearnsi* var. *inerme* Annandale, 1905. Specimen, lateral view. Size 1/1.

Fig. 2. *Scalpellum persona* Annandale, 1916. Specimen, lateral view. Size 1/1.

Fig. 3. *Scalpellum sociabile* Annandale, 1905. Specimen, lateral view. Size 1/1.

Fig. 4. *Balanus amphitrite poeciloscalpta* Broch, 1931. Specimens on a gorgonian stem. Size 1, 8/1.

Fig. 5. *Balanus amphitrite rafflesi* n. subsp. Specimens, lateral view. Size 2/1.

Fig. 6. *Balanus amphitrite rafflesi* n. subsp. Specimens, apical view. Size 2/1.

Fig. 7. *Balanus ciliatus* Hoek, 1913. Specimens, lateral view. Size 2, 2/1.

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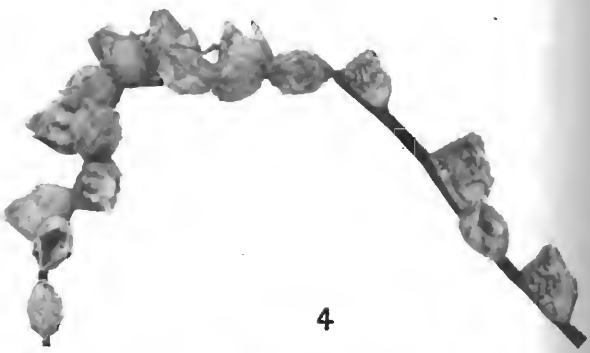

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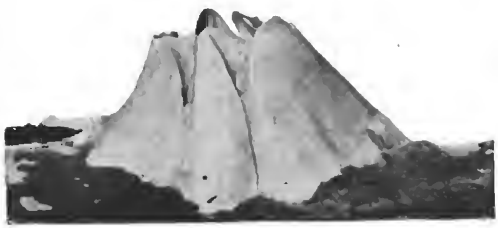

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Indo-Malayan Cirripeds.